CLAIMS

We Claim:

1. In a data storage device having one or more media surfaces, a corresponding number of at least read devices, a spindle motor for moving the one or more media surfaces, an actuator for moving the at least read devices relative to the one or more media surfaces, a read device preamplifier, coupled to the at least read devices, a servo control coupled to the actuator, for driving the actuator in response to control signals, an integrated data storage device controller integrated circuit comprising:

a host interface for interfacing with a host computer;

at least one internal communications and control bus, for transferring stored data and control data to and from elements within the integrated data storage device controller and interconnected with the host interface to transfer stored data and control data to and from the integrated data storage device controller;

a read device data processor, coupled to the read device preamplifier and the at least one internal communications and control bus, for receiving and processing read device data from the read device preamplifier;

a motion control servo logic, coupled to the at least one internal communications and control bus, and to the servo control, for generating control signals for driving the servo control;

a disc controller, coupled to the at least one internal communications bus, for transferring stored data to the host interface; and

a microcontroller, coupled to the at least one internal communications bus, for generating control data to control devices within the integrated data storage device controller integrated circuit.

2. The integrated data storage device controller integrated circuit of claim 1, wherein the data storage device comprises an optical disc drive, the one or more media surfaces comprises an optical disc, and the corresponding number of at least read devices comprises a laser.

3. The integrated data storage device controller integrated circuit of claim 2, wherein the optical disc drive comprises a CD-ROM drive and the optical disc comprises a CD-ROM.

4. The integrated data storage device controller integrated circuit of claim 2, wherein the optical disc drive comprises a DVD drive, and the optical disc comprises a DVD.

5. The integrated data storage device controller integrated circuit of claim 2, wherein the optical disc drive comprises a compact disc drive, and the optical disc comprises a compact disc.

6. The integrated data storage device controller integrated circuit of claim 2, wherein the optical disc drive comprises a CD-R drive, and the optical disc comprises a CD-R.

7. The integrated data storage device controller integrated circuit of claim 2, wherein the optical disc drive comprises a CD-RW drive, and the optical disc comprises a CD-RW.

8. The integrated data storage device controller integrated circuit of claim 1, wherein the data storage device comprises a floppy disk drive, the one or more media surfaces comprises a

magnetic floppy disk, and the corresponding number of at least read devices comprises a read/write head.

9. The integrated data storage device controller integrated circuit of claim 1, wherein the data storage device controller integrated circuit is rendered in complimentary Metal Oxide Semiconductor (CMOS) transistor circuitry.

10. The integrated data storage device controller integrated circuit of claim 1, further comprising:

a digital signal processor, coupled to the at least one internal communications bus, for processing raw stored data from the read device data processor and outputting processed stored data.

11. The integrated data storage device controller integrated circuit of claim 10, wherein said microcontroller comprises:

a microprocessor having a set of instructions for controlling a data storage device; and

an internal memory for storing a first speed critical portion of microprocessor code and data containing instructions for

processing, retrieving, and storing data to and from the data storage device,

wherein the microprocessor accesses an external memory through the at least one internal communications bus to access a second non-speed critical portion of microprocessor code and data containing instructions not related to processing, retrieving, and storing date to and from the data storage device.

12. The integrated data storage device controller integrated circuit of claim 11, wherein said at least one internal communications bus comprises:

a microcontroller local bus coupled to said microprocessor and said internal memory for transferring the microprocessor code and data to and from the microprocessor;

a peripheral bus coupled to said microprocessor with said read device data processor and at least read device data processor, said motion control servo logic, said disc drive controller, and said digital signal processor;

an external memory bus, coupled to said microprocessor and an external memory, for transferring microprocessor code and data to and from said microprocessor; and

a bus/memory controller, coupled to and interfacing said microcontroller local bus, said peripheral bus, and said external memory bus.

13. The integrated data storage device controller integrated circuit of claim 12, wherein a first portion of elements are provided as hard design blocks, and a second portion of elements are provided as soft design blocks such that the soft block components may be readily redesigned without redesigning the hard block components in order to customize the integrated data storage device controller integrated circuit.

14. The integrated data storage device controller integrated circuit of claim 1, wherein said internal communications bus further comprises:

a MUX for selectively multiplexing outputs of one or more of the disc controller, the microprocessor, and the read device data processor with one or more I/O pins such that the integrated circuit may selectively output signals from one or more of the of the disc controller, the microprocessor, the read device data processor.

15. The integrated data storage device controller integrated circuit of claim 1, wherein said internal communications bus further comprises:

a MUX for selectively multiplexing outputs of one or more of the disc controller, the microprocessor, and the read device data processor with one or more I/O pins such that the integrated data storage device controller integrated circuit may selectively operate as a discrete disc controller, component microprocessor, and read device data processor.

16. A data storage device comprising:

one or more media surfaces;

a number of at least read devices corresponding to the one or more media surfaces;

a spindle motor for moving the one or more media surfaces;

an actuator for moving the at least read devices relative to the media surfaces;

a read device preamplifier, coupled to the number of at least read devices;

a servo control coupled to the actuator, for driving the actuator in response to control signals; and

an integrated data storage device controller integrated circuit comprising:

at least one internal communications and control bus, for transferring stored data and control data to and from elements within the integrated data storage device controller and with a host interface to transfer stored data and control data to and from the integrated data storage device controller;

a read device data processor, coupled to the read device preamplifier and the at least one internal communications and control bus, for receiving and processing read device data from the read device preamplifier;

a motion control servo logic, coupled to the servo control, for generating control signals for driving the servo control;

a disc controller, coupled to the at least one internal communications bus, for transferring stored data to the host interface; and

a microcontroller, coupled to the at least one internal communications bus, for generating control data to control devices within the integrated data storage device controller integrated circuit.

17. The data storage device of claim 16, wherein the data storage device comprises an optical disc drive, the one or more

media surfaces comprises an optical disc, and the corresponding number of at least read devices comprises a laser.

18. The data storage device of claim 17, wherein the optical disc drive comprises a CD-ROM drive and the optical disc comprises a CD-ROM.

19. The data storage device of claim 17, wherein the optical disc drive comprises a DVD drive, and the optical disc comprises a DVD.

20. The data storage device of claim 17, wherein the optical disc drive comprises a compact disc drive, and the optical disc comprises a compact disc.

21. The data storage device of claim 17, wherein the optical disc drive comprises a CD-R drive, and the optical disc comprises a CD-R.

22. The data storage device of claim 17, wherein the optical disc drive comprises a CD-RW drive, and the optical disc comprises a CD-RW.

23. The data storage device of claim 16, wherein the data storage device comprises a floppy disk drive, the one or more media surfaces comprises a magnetic floppy disk, and the corresponding number of at least read devices comprises a read/write head.

24. The data storage device of claim 16, wherein the data storage device controller integrated circuit is rendered in complimentary Metal Oxide Semiconductor (CMOS) transistor circuitry.

25. The data storage device of claim 24, wherein said integrated data storage device controller integrated circuit further comprises:

a digital signal processor, coupled to the at least one internal communications bus, for processing raw stored data from the read device data processor and outputting processed stored data.

26. The data storage device of claim 25, wherein said microcontroller comprises:

a microprocessor having a limited command set of instructions optimized for controller a data storage device; and

an internal memory for storing a first portion of microprocessor code containing instructions for processing, retrieving, and storing data to and from the data storage device,

wherein the microprocessor accesses an external memory through the at least one internal communications bus to access a second portion of microprocessor code containing instructions not related to processing, retrieving, and storing date to and from the data storage device.

27. The data storage device of claim 26, wherein said at least one internal communications bus comprises:

a microcontroller local bus coupled to said microprocessor and said internal memory for transferring the microprocessor code and data to and from the microprocessor;

a peripheral bus coupled to said microprocessor with said read device data processor, said motion control servo logic, said disc drive controller, and said digital signal processor;

an external memory bus, coupled to said microprocessor and an external memory, for transferring microprocessor code and data to and from said microprocessor; and

a bus/memory controller, coupled to and interfacing said microcontroller local bus, said peripheral bus, and said external memory bus.

28. The data storage device of claim 27, wherein said read device data processor, said microprocessor, and said internal memory are provided as hard design blocks, and said disc controller and servo controller are provided as soft design blocks such that the soft block components may be readily redesigned without redesigning the hard block components in order to customize the integrated data storage device controller integrated circuit.

29. The data storage device of claim 28, wherein said internal communications bus further comprises:

a MUX for selectively multiplexing outputs of the disc controller, the microprocessor, and the read device data processor with one or more I/O pins such that the integrated data storage device controller integrated circuit may selectively operate as a

discrete disc controller, component microprocessor, a read device data processor.

30. In a data storage device having one or more media surfaces, a corresponding number of at least read devices, a spindle motor for moving the one or more media surfaces, an actuator for moving the at least read devices relative to the media surfaces, a read device preamplifier, coupled to the number of at least read devices, a servo control coupled to the actuator, for driving the actuator in response to control signals, an integrated data storage device controller integrated circuit comprising at least one internal communications and control bus, for transferring stored data and control data to and from elements within the integrated data storage device controller and interconnected with a host interface to transfer stored data and control data to and from the integrated data storage device controller, a read device data processor, coupled to the read device preamplifier and the at least one internal communications and control bus, for receiving and processing read device data from the read device preamplifier, a motion control servo logic, coupled to the servo control, for generating control signals for driving the servo control, a disc controller, coupled to the at least one internal communications bus, for transferring stored data to the host interface, and a

microcontroller, coupled to the at least one internal communications bus, for generating control data to control devices within the integrated data storage device controller integrated circuit, a method of testing the integrated circuit data storage device controller, comprising the step of:

selectively multiplexing outputs of one or more of the disc controller, the microprocessor, and the read device data processor with one or more I/O pins such that the integrated circuit may selectively output signals from one or more of the of the disc controller, the microprocessor, read device data processor.

31. The method of claim 30, wherein the data storage device comprises an optical disc drive, the one or more media surfaces comprises an optical disc, and the corresponding number of at least read devices comprises a laser.

32. The method of claim 31, wherein the optical disc drive comprises a CD-ROM drive and the optical disc comprises a CD-ROM.

33. The method of claim 31, wherein the optical disc drive comprises a DVD drive, and the optical disc comprises a DVD.

34. The method of claim 31, wherein the optical disc drive comprises a compact disc drive, and the optical disc comprises a compact disc.

35. The method of claim 31, wherein the optical disc drive comprises a CD-R drive, and the optical disc comprises a CD-R.

36. The method of claim 31, wherein the optical disc drive comprises a CD-RW drive, and the optical disc comprises a CD-RW.

37. The method of claim 30, wherein the data storage device comprises a floppy disk drive, the one or more media surfaces comprises a magnetic floppy disk, and the corresponding number of at least read devices comprises a read/write head.

38. The method of claim 30, wherein said step of selectively multiplexing further comprises the step of:

selectively multiplexing outputs of the disc controller, the microprocessor, and read device data processor with one or more I/O

pins such that the integrated data storage device controller integrated circuit may selectively operate as a discrete disc controller, component microprocessor, and read device data processor.

39. In a tape drive having one or more media surfaces, a corresponding number of at least read devices, a spindle motor for moving the one or more media surfaces, a read device preamplifier, coupled to the number of at least read devices, a servo control coupled to the spindle motor for driving the spindle motor in response to control signals, an integrated tape drive controller integrated circuit comprising:

a host interface for interfacing with a host computer;

at least one internal communications and control bus, for transferring stored data and control data to and from elements within the integrated tape drive controller and interconnected with the host interface to transfer stored data and control data to and from the integrated tape drive controller;

a read device data processor, coupled to the read device preamplifier and the at least one internal communications and control bus, for receiving and processing read device data from the read device preamplifier;

a motion control servo logic, coupled to the at least one internal communications and control bus, and to the servo control, for generating control signals for driving the servo control;

a disc controller, coupled to the at least one internal communications bus, for transferring stored data to the host interface; and

a microcontroller, coupled to the at least one internal communications bus, for generating control data to control devices within the integrated tape drive controller integrated circuit.

40. The integrated tape drive controller integrated circuit of claim 39, wherein the tape drive controller integrated circuit is rendered in complimentary Metal Oxide Semiconductor (CMOS) transistor circuitry.

41. The integrated tape drive controller integrated circuit of claim 39, further comprising:

a digital signal processor, coupled to the at least one internal communications bus, for processing raw stored data from the read device data processor and outputting processed stored data.

42. The integrated tape drive controller integrated circuit of claim 41, wherein said microcontroller comprises:

a microprocessor having a set of instructions for controlling a tape drive; and

an internal memory for storing a first speed critical portion of microprocessor code and data containing instructions for processing, retrieving, and storing data to and from the tape drive,

wherein the microprocessor accesses an external memory through the at least one internal communications bus to access a second non-speed critical portion of microprocessor code and data containing instructions not related to processing, retrieving, and storing date to and from the tape drive.

43. The integrated tape drive controller integrated circuit of claim 42, wherein said at least one internal communications bus comprises:

a microcontroller local bus coupled to said microprocessor and said internal memory for transferring the microprocessor code and data to and from the microprocessor;

a peripheral bus coupled to said microprocessor with said read device data processor, said motion control servo logic, said disc drive controller, and said digital signal processor;

an external memory bus, coupled to said microprocessor and an external memory, for transferring microprocessor code and data to and from said microprocessor; and

a bus/memory controller, coupled to and interfacing said microcontroller local bus, said peripheral bus, and said external memory bus.

44. The integrated tape drive controller integrated circuit of claim 43, wherein a first portion of elements are provided as hard design blocks, and a second portion of elements are provided as soft design blocks such that the soft block components may be readily redesigned without redesigning the hard block components in order to customize the integrated tape drive controller integrated circuit.

45. The integrated tape drive controller integrated circuit of claim 39, wherein said internal communications bus further comprises:

a MUX for selectively multiplexing outputs of one or more of the disc controller, the microprocessor, and the read device data processor with one or more I/O pins such that the integrated circuit may selectively output signals from one or more of the of

the disc controller, the microprocessor, and the read device data processor.

46. In a hard disk drive having one or more disk surfaces, a corresponding number of read/write heads, a spindle motor for rotating the disk surfaces, a voice coil motor for moving the heads relative to the disk surfaces, a head preamplifier, coupled to the number of read/write heads, a servo control coupled to the voice coil motor for driving the voice coil motor in response to control signals, an integrated hard disk drive controller integrated circuit comprising at least one internal communications and control bus, for transferring stored data and control data to and from elements within the integrated hard disk drive controller and interconnected with a host interface to transfer stored data and control data to and from the integrated hard disk drive controller, at least one of a read channel controller and a read/write channel controller, coupled to the head preamplifier and the at least one internal communications and control bus, for receiving and processing read channel data from the head preamplifier, a motion control servo logic, coupled to the servo control, for generating control signals for driving the servo control, a disk controller, coupled to the at least one internal communications bus, for transferring stored data to the host interface, and

a microcontroller, coupled to the at least one internal communications bus, for generating control data to control devices within the integrated hard disk drive controller integrated circuit, a method of testing the integrated circuit hard disk drive controller, comprising the step of:

selectively multiplexing outputs of one or more of the disk controller, the microprocessor, and the at least one of a read channel controller and a read/write channel controller with one or more I/O pins such that the integrated circuit may selectively output signals from one or more of the of the disk controller, the microprocessor, and the at least one of a read channel controller and a read/write channel controller.

47. The method of claim 46, wherein said step of selectively multiplexing further comprises the step of:

selectively multiplexing outputs of the disk controller, the microprocessor, and the at least one of a read channel controller and a read/write channel controller with one or more I/O pins such that the integrated hard disk drive controller integrated circuit may selectively operate as a discrete disk controller, component microprocessor, and at least one of a read channel controller and a read/write channel controller.

48. A method of testing an integrated circuit comprising a plurality of predetermined circuit blocks corresponding to discrete component circuits, said method comprising the step of:

selectively multiplexing outputs of one or more of the plurality of discrete component circuit blocks with one or more I/O pins such that the integrated circuit may selectively output signals from one or more of the predetermined circuit blocks.

49. The method of claim 48, wherein said step of selectively multiplexing further comprises the step of selectively multiplexing outputs of one or more of the plurality of discrete component circuit blocks with one or more I/O pins such that the integrated circuit may selectively operate as discrete component corresponding to one of the predetermined circuit blocks.